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The fangs of *Atractaspis engaddensis* Haas (Serpentes: Atractaspididae)

by

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With 5 figures

Abstract

Snakes of the genus *Atractaspis* differ from the other front-fanged venomous snakes in their general and cranial anatomy, including the maxillary-fang mechanism. Some of these modifications are clearly related to their burrowing habits. The present study deals with the structure of their fangs, as revealed by light and scanning electron microscopy. A sharp edge protrudes from the surface of the fang opposite its distal orifice, apparently enabling the venom to flow efficiently into the prey's tissue.

INTRODUCTION

The biting mechanism of snakes has attracted considerable attention over the years and has been dealt with by both herpetologists and clinicians treating snake-bite cases. It was clearly evident that the amount of venom injected is of prime importance to the course of envenomation and may determine the fate of the patient. What was less well understood was the factor or factors that influence the quantity of venom introduced during the bite (cf. Kochva 1978 for review). Moreover, the factors that are involved in the distribution of venom were sought in the human body or in the venom composition, but not in the biting apparatus itself.

It is well known that the length of the fangs will determine, to a certain extent, the depth of venom penetration, but their shape and structure should also be considered in this context (Bogert 1943; Smith 1952). The degree of closure of the venom canal, its entrance and exit openings, and various ridges and edges found on the fang surface were

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described in different snakes. Their first appearance may date back to certain snake-like reptiles found by the late Professor Haas in the upper Cenomanian at Ein Jabrud, north of Jerusalem (HAAS 1979, 1980; KOCHVA MS).

In a recent paper, MEIER (1981) described the fangs of *Dispholidus typus* and *Thelotornis kirtlandii,* two snakes that are known to have caused human fatalities. Using scanning electron microscopy, MEIER showed that these fangs have a deep groove that passes distally into a blade-like ridge, which may have an important function in promoting the penetration of venom into the wound. This ridge may also facilitate the distribution of venom by causing damage to the surrounding tissues. This is of special importance in colubrid snakes that may have a potent secretion (venom), but a gland that does not have an extensive lumen and, therefore, no large quantities of venom in store.

These snakes hold onto their prey and make, what appear to be, chewing movements with their jaws that might increase the wound caused by the initial bite. It is during this process that the blade-like ridges found on the fangs exert their function in facilitating both venom flow and penetration, and venom distribution.

Fang ridges are found also in the genuinely venomous snakes, and were described, but not illustrated, by VISSER (1975) in *Bitis, Naja* and *Atractaspis.*

It is now established that the snakes of the genus *Atractaspis* belong to a separate group of venomous snakes at the level of familial or subfamilial rank (KOCHVA *et al.,* 1982).

In this communication, we deal with the rather special projections found on the fangs of *Atractaspis engaddensis,* which, we believe, are important for their peculiar way of striking (GOLANI & KOCHVA, MS).

The specimens examined were collected in the Negev desert and Dead Sea region (Israel). About ten specimens have been used for this study, one of them for the scanning electron microscope study.

DESCRIPTION AND COMMENTS

The biting apparatus of *Atractaspis* may be distinguished from that of the Viperidae, among others, by the connection between the maxillary and prefrontal bones. These bones are linked in a ball and socket articulation (Fig. 1), which ensures a firm rotation of the maxillary with the fang during the one-sided, closed-mouth strike, characteristic of these snakes (GOLANI & KOCHVA, MS). The fangs are small in absolute terms (3-4 mm), but in relation to the skull length (1: 3-1: 4) they are approximately in the middle of the range, between the Viperidae and the Elapidae, though perhaps somewhat closer to the former (cf. VISSER 1975). The fang canal is completely closed (Fig. 4) and the distal, slit-shaped orifice opens less than one mm from the tip of the fang (Fig. 5). Across the distal end of this orifice, a sharp edge protrudes from the surface of the fang and slopes down towards the tip of the fang (Figs 2, 3, 5). This projection, which is about 0.03 mm at its highest point, is found on the posterior aspect of the fang (when fully erected).

During the bite, after the fang has penetrated the prey, it apparently swings backward and upward and then forward, while it injects the venom. In all these movements, the fang projection should be of considerable use. It will cut through the tissues while penetrating the body, it will increase the wound while moving backward and upward and will serve as a hook during the forward movement, or in the case of the prey trying to escape too soon.

The sharp projections on the fangs of *Atractaspis* are yet another adaptation, probably connected with the special striking behaviour of these snakes. These projections may ensure that the venom, which is highly toxic but very little of which is injected in a bite, does penetrate properly into the prey.

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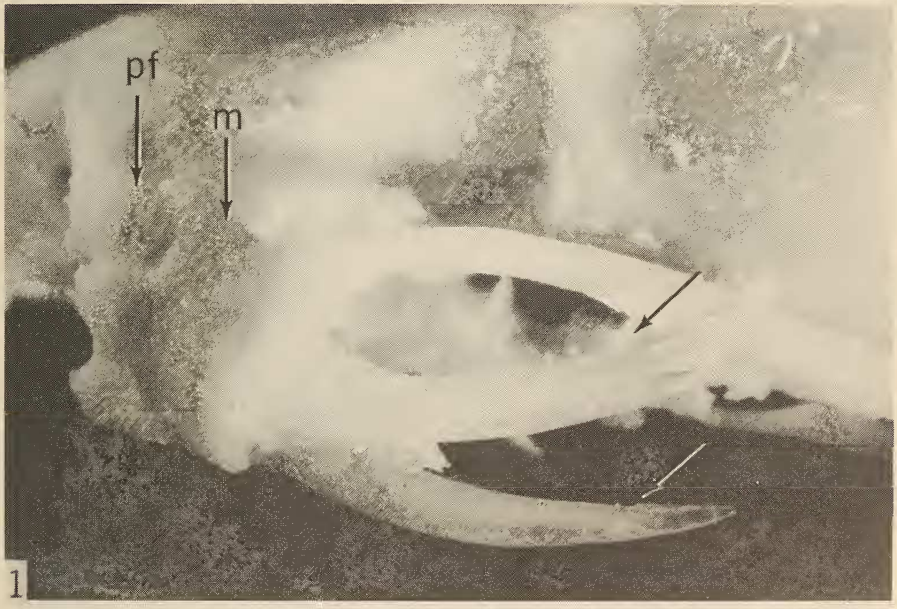
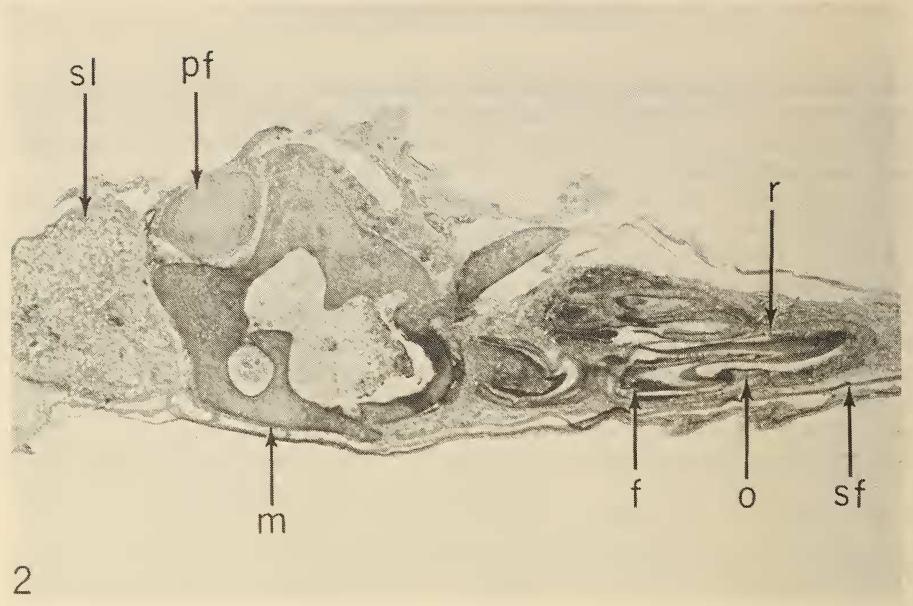


Figure 1.

Maxilla and fangs of *Atractaspis engaddensis*. Approximately 30×.
Note the ball and socket articulation between the prefrontal and maxillary bones and the ridges on the functional and replacement fangs (arrows). m – maxilla; pf – prefrontal.



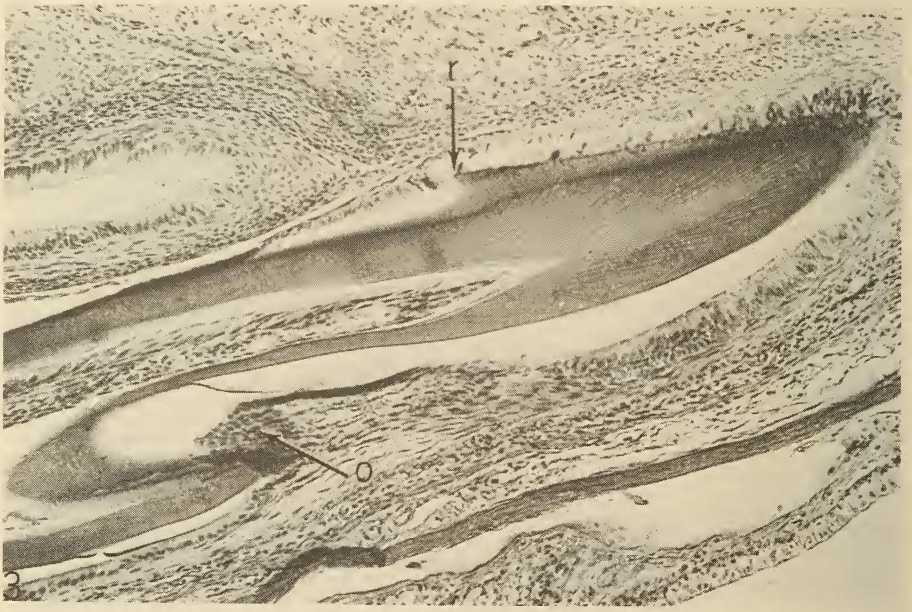


FIGURE 2.

Sagittal section through the maxilla and fangs. f – fang; m – maxilla; o – distal opening of fang; pf – ball-shaped projection of prefrontal; r – ridge of fang; sf – sheath of fang; sl – supralabial glands. Light microscopy. Approximately 25×.

FIGURE 3.

Sagittal section through distal tip of fang. o – distal opening of fang; r – ridge of fang. Approximately 150×.

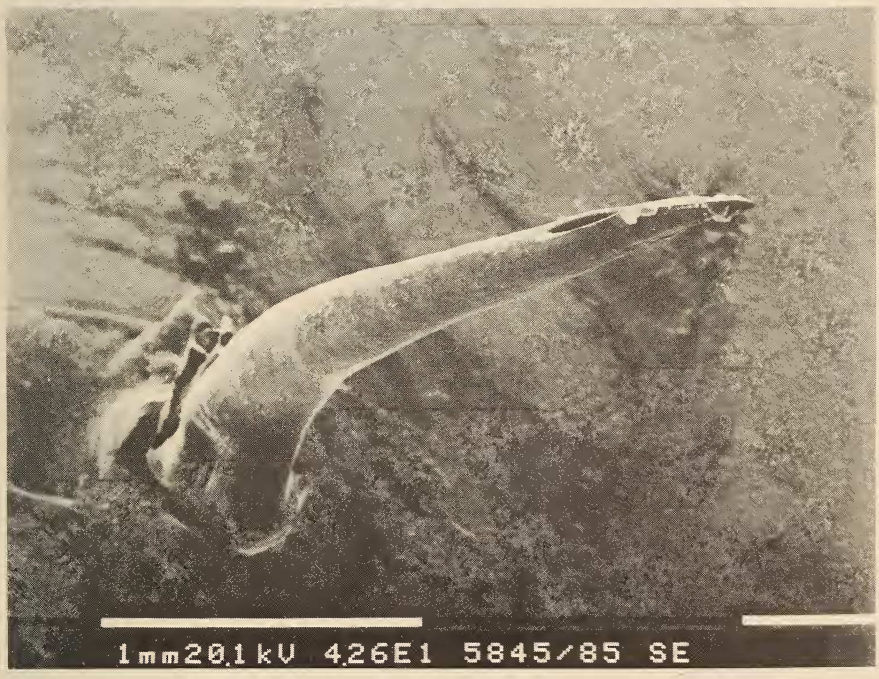


FIGURE 4.

Fang of *A. engaddensis.* Approximately 38×, SEM. Note that the fang canal is completely closed up to the slit-shaped distal orifice.

FIGURE 5.

Tip of the fang. Approximately 189×, SEM. Note the sharp edge protruding from the surface of the fang on its posterior aspect.

Zusammenfassung

Erdvipern der Gattung *Atractaspis* unterscheiden sich von den übrigen Giftschlangen, nebst ihrer unterirdischen Lebensweise in mancherlei Hinsicht. Von besonderem Interesse sind die Modifikationen im Schädelbau und insbesondere im Bereich des Giftapparates. Die licht- und rasterelektronenmikroskopische Untersuchung ihrer Giftzähne zeigte, dass sich der Giftaustrittsöffnung gegenüberliegend auf der Zahnhinterseite eine messerartige Struktur befindet, die das Eindringen des Giftes in einen Beuteorganismus erleichtert.

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